REMARKS

Please reconsider the application in view of the above amendments and the following remarks. Applicant thanks the Examiner for carefully considering this application.

Disposition of Claims

Claims 1-28 are currently pending in this application. Claims 15-21 have been canceled by this reply. Of the remaining claims, claims 1, 8, and 22 are independent. The remaining claims depend, directly or indirectly, from claims 1, 8, and 22.

Specification

The Examiner has objected to the title of the invention as not being descriptive. The title of the invention has been amended to "Concurrent Incremental Garbage Collector With a Card Table Summarizing Modified Reference Locations" per the Examiner's suggestion.

Further, the Examiner objects to the Specification for handwritten corrections on pages 35-37. The paragraphs containing handwritten corrections in the Specification have been formally corrected in the amendments made to the Specification.

Accordingly, withdrawal of the objections to the Specification and the title are respectfully requested.

Abstract

The Examiner objects to the Abstract for a minor informality. The Abstract has been amended to expand the acronym CAS to compare-and-swap. Accordingly, withdrawal of this objection is respectfully requested.

Claim Objections

The Examiner objects to claims 6, 10, and 11 for minor typographical errors. The errors in claims 6, 10, and 11 have been corrected per the Examiner's suggestions. Accordingly, withdrawal of these objections is respectfully requested.

Claim Amendments

The independent claims have been amended to clarify that updating card table indicators or remembered sets includes storing a location of referencing objects within the card table indicators or remembered sets.

Support for this amendment may be found, for example, in Figures 12A-12J and the corresponding text in the Specification. Applicant asserts that no new subject matter has been added by way of these amendments.

Rejections under 35 U.S.C. § 101

Claims 15-21 stand rejected under 35 U.S.C. § 101 as being directed toward non-statutory subject matter. Claims 15-21 have been canceled by this reply. Thus, this rejection is now moot.

Rejections under 35 U.S.C. § 102

Claims 1-4, 6, 8-11, 13, 15-18, 20, 22-25, and 27 stand rejected under 35 U.S.C. § 102(e) as being anticipated by US Patent No. 6,490,599 ("Kolodner"). Claims 15-18 and 20 have been canceled by this reply. Thus, this rejection is now moot with respect to claims 15-18 and 20. To the extent that this rejection may still apply to the remaining amended claims, this rejection is respectfully traversed.

The present invention relates to a concurrent method for updating an object's references by updating the object's card table indicator or remembered set. An object's references indicate which objects in other memory sections or other generations point to that object. For example, is object A points to object L, then object L's remember set contains the location of object A, indicating that object L has a reference to it from object A's location. As shown in Figures 6 and 12A-12J of the present invention, a remember set or a card table indicator actually contains the locations of an object's references.

Accordingly, the independent claims of the present invention have been amended to recite that updating the remembered sets or card table indicators of objects in a dirtied memory section comprises storing at least one location of referencing objects.

In contrast to the claimed invention, Kolodner relates to an "on-the-fly" garbage collector that manipulates a dirty bit value and identifier values represented by a color scheme of objects while performing garbage collecting (*see* Kolodner, col. 5, ll. 45-50). In Kolodner, the manipulation of dirty bits and colors is synchronized so that the program thread and the garbage collector do not erroneously categorize a particular object as being dirty/not dirty or of a particular color that the object is not. The color scheme used in Kolodner (*see* Kolodner, col.8, ll. 50-54), is used to represent whether an object is referenced by another object or by a root (registers or the stack) or whether an object is not referenced at all (*see* Kolodner, col. 4, ll. 1-15). When the garbage collector processes objects to see whether objects are "alive" or can be reclaimed, the garbage collector updates the color of objects to indicate that the object is referenced by another object (*see* Kolodner, col. 8, ll. 5-16). The color scheme of Kolodner does not indicate the location of an object's referencing object, but rather, *only indicates that an*

object is referenced by another object (i.e., that is object is "alive" and therefore cannot be reclaimed).

Turning to the rejection of the claims, the Examiner appears to be equating the color scheme manipulation performed by the garbage collector of Kolodner with the updates made to an object's references in the object's remembered set or card table indicator, as required by the amended independent claims. Applicant respectfully disagrees. As described above, manipulating the color scheme that indicates whether an object is referenced by another object is completely distinct from actually *storing the location* of the object that references an object in a dirtied area of memory. Because the color scheme manipulated by a garbage collector only indicates on a surface-level whether that object can be reclaimed, it is clear that Kolodner does not update a card table indicator or remembered set as required by the amended independent claims of the present invention.

Further, Kolodner fails to disclose that card table indicators are preserved as having just been interrogated, after the second time that an atomical interrogation is performed to search for dirty indicators. Preserving indicators as "just interrogated" allows the garbage collector to maintain the summarization for card table entries/remembered sets while still recording newly dirtied bytes (objects). The garbage collector can then process these recorded newly dirtied objects at a later collection interval (*see* Specification, page 36). Kolodner fails to disclose anything related to marking a newly dirtied object as "just interrogated" after an interrogation has been performed once already for that particular memory section. In fact, the cited portion of Kolodner only discloses that an object that was marked dirty during the previous collection cycle is unnecessarily scanned if the collector's setting of the dirty bit fails (*see* Kolodner, col. 9, ll. 56-59). The cited portion of Kolodner does not mention preserving an object that is newly

discovered as being dirty after the memory section of the object *has already been interrogated once*, as required by the independent claims.

In view of the above, Kolodner fails to support the rejection of amended independent claims 1, 8, and 22. Further, dependent claims 2-4, 6, 9-11, 13, 23-25, and 27 are patentable for at least the same reasons. Accordingly, withdrawal of this rejection is respectfully requested.

Rejections under 35 U.S.C. § 103

Claims 5, 12, 19, and 26 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Kolodner. Claim 19 has been canceled by this reply. Thus, this rejection is now moot with respect to claim 19. To the extent that this rejection may still apply to the remaining amended claims, this rejection is respectfully traversed.

As described above, Kolodner fails to teach or suggest the limitations of amended independent claims 1, 8, and 22. Thus, amended independent claims 1, 8, and 22 are patentable over Kolodner. Dependent claims 5, 12, and 26 are patentable for at least the same reasons. Accordingly, withdrawal of this rejection is respectfully requested.

Claims 7, 14, 21, and 28 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kolodner in view of US Publication No. 2002/0055941 ("Kolodner Publication"). Claim 21 has been canceled by this reply. Thus, this rejection is now moot with respect to claim 21. To the extent that this rejection may still apply to the remaining amended claims, this rejection is respectfully traversed.

As described above, Kolodner fails to disclose or suggest the limitations of the amended independent claims. Further, Kolodner Publication fails to supply that which Kolodner lacks, as evidenced by the fact that the Examiner relies on Kolodner Publication solely for the purpose of

disclosing that the card table indicators comprise a card table of bytes that correspond to memory cards (*see* Office Action mailed June 7, 2006, page 14).
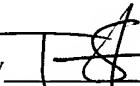
In view of the above, it is clear that amended independent claims 1, 8, and 22 are patentable over Kolodner and Kolodner Publication, whether considered separately or in combination. Further, dependent claims 7, 14, and 28 are patentable for at least the same reasons. Accordingly, withdrawal of this rejection is respectfully requested.

Conclusion

Applicant believes this reply is fully responsive to all outstanding issues and places this application in condition for allowance. If this belief is incorrect, or other issues arise, the Examiner is encouraged to contact the undersigned or his associates at the telephone number listed below. Please apply any charges not covered, or any credits, to Deposit Account 50-0591 (Reference Number 03226/936001).

Dated: November 7, 2006   Respectfully submitted,

By_____ # 45,079

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